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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/814,682
Filing Date: March 31, 2004
Appellant(s): LIN ET AL.

Greg H. Parker
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 10/27/2008 appealing from the Office action mailed 05/02/2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,500,391	Bevk et al.	03-1996
5,891,769	Liaw et al.	04-1999
7,067,856 B2	Ramadani et al.	06-2006

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 41-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bevk et al., (U.S. 5,500,391, hereinafter Bevk) in view of Liaw et al. (U.S. 5,891,769, hereinafter Liaw).

In reference to claim 41, Bevk (Fig.6) teaches a CMOS device including a germanium buried layer (20) located over a doped substrate (10), wherein a middle portion of said buried layer (20) is labeled co-doped germanium buried layer; and a doped epitaxial layer (30) located over said co-doped germanium buried layer (20) (Bevk, column 2, line 45 – column 4, line 19).

Bevk fails to expressly disclose a gate structure, wherein said gate structure including a gate dielectric gate electrode, and source and drain regions. However, this is inherent in Bevk since Bevk is directed to the formation of a CMOS structure. Accordingly Bevk teaches upon the recited limitation.

Still Bevk fails to disclose wherein said source/drain regions do not extend into said co-doped germanium buried layer.

However, Liaw (Figs.1 and 4) teaches a field effect transistor device including a substrate (Fig.1, '11' and Fig.4, '51'); a buried layer (Fig.1, '12' and Fig.4, '53') on said substrate (Fig.1, '11' and Fig.4, '51'); an epitaxial layer (Fig.1, '19' and Fig.4, '54') on said buried layer (Fig.1, '12' and Fig.4, '53'); a gate structure (Fig.1, '22', Fig.4, '58') and source/drain regions (Fig.1, '16', '17', Fig.4, '56', '57'), wherein in one embodiment of the invention (Fig.1) the source/drain regions extends into said buried layer, wherein in a second embodiment of the invention (Fig.4) the source/drain regions does not extend into the buried layer, and wherein said buried layer (Fig.1, '12' and Fig.4, '53') is a co-doped germanium layer, SiC, AlN, or the like (Liaw, column 2, lines 36 – 56, column 3, lines 14 – 26, column 5, lines 36 – 50 and column 6, lines 17 – 39).

Furthermore, one of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization to obtain a desired CMOS device with desired source/drain regions. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232

(1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Therefore, it would have been within the scope of one of ordinary skill in the art to combine the teachings of Bevk and Liaw to enable the disclosed source/drain regions of the CMOS of Bevk according to the teachings of Liaw because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful source/drain regions in Bevk and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claim 42, the combined teachings of Bevk and Liaw teach wherein said co-doped germanium buried layer includes a p-type dopant (Bevk, column 4, lines 5 – 19).

In reference to claim 43, the combined teachings of Bevk and Liaw teach wherein said p-type dopant is boron (Bevk, column 4, lines 5 – 19).

In reference to claim 44, the combined teachings of Bevk and Liaw teach wherein said co-doped germanium buried layer should have a mole fraction of at least 0.1 and wherein the germanium concentration determines a level of strain and critical thickness (Bevk, column 2, lines 50 – 64), but fails to disclose wherein said co-doped germanium buried layer has a germanium concentration ranging from abut $1x10^{20}$ atoms/cm^3 to about $7x10^{20}$atoms/cm^3.

However, the selection of the claimed germanium concentration is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired germanium co-

doped layer with a desired strain and thickness. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable using the combination of Bevk and Liaw to arrive at the claimed limitation using routinary experimentation.

In reference to claim 45, the combined teachings of Bevk and Liaw substantially teach all aspects of the invention but fails to expressly disclose wherein said co-doped germanium buried layer has a thickness ranging from about 1 μm to about 10 μm.

One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization to obtain a desired buried layer. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

In reference to claim 46, the combined teachings of Bevk and Liaw substantially teach all aspects of the invention but fail to expressly disclose wherein said doped substrate, said co-doped germanium buried layer, and said epitaxial layer collectively have a thickness ranging from about 2 μm to about 20 μm.

One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization to obtain a desired substrate. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

In reference to claims 47 and 50 the combined teachings of Bevk and Liaw teach wherein the germanium layer has a graded germanium concentration, wherein said gradation is, for example, triangular grading or parabolic distribution (Bevk, column 2, line 65 – column 3, line 4), and wherein the dopant concentration of the dopant within said germanium layer is greater than in said substrate and said epitaxial layer (Bevk, column 4, lines 6 – 20), wherein a first portion of the germanium layer immediately next

to the substrate is labeled first doped lattice matching layer, wherein a second portion immediately next to the doped epitaxial layer is labeled second doped lattice matching layer, wherein a third portion next to said first portion is labeled third doped lattice portion, and wherein a fourth portion next to said second portion is labeled fourth doped lattice matching layer. Therefore, the combined teachings of Bevk and Liaw teach upon the claimed invention.

In reference to claim 48, the combined teachings of Bevk and Liaw teach wherein dopant concentrations of said first and second doped lattice matching layers are each less than a dopant concentration of said co-doped germanium buried layer (Bevk, Fig.6).

In reference to claim 49, the combined teachings of Bevk and Liaw teach wherein a dopant concentration of said doped substrate is less than said dopant concentration of said first doped lattice matching layer and a dopant concentration of said doped epitaxial layer is less than said dopant concentration of said second doped lattice matching layer (Bevk, Fig. 6).

In reference to claim 51, the combined teachings of Bevk and Liaw teach wherein a dopant concentration of said third doped lattice matching layer is more than said dopant concentration of said first doped lattive matching layer and a dopant concentration of said fourth doped lattice matching layer is more than said dopant concentration of said second doped lattice matching layer (Bevk, Fig.6).

In reference to claim 52, the combined teachings of Bevk and Liaw teach wherein said first and second doped lattice batching layers each include a dopant gradient

wherein a dopant concentration of each of said dopant gradients is greater adjacent said co-doped germanium buried layer (Bevk, Fig.6).

3. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bevk ('391) in view of Liaw ('769) as applied to claims 40-52 above, and further in view of Ramadani et al. (U.S. 7,067,856 B2, hereinafter Ramadani).

The combined teachings of Bevk and Liaw substantially teach all aspects of the invention but fail to expressly disclose wherein said transistor structure further includes interconnects located within interlevel dielectric layers located over transistors, which connect the transistors to form an operational integrated circuit and additional active and passive devices.

However, it is well-known in the art directed to MOS devices that these devices further include interconnects and other active and passive devices located within interlevel dielectric layers located over the transistors, which connect the transistors to form an operational integrated circuit. Further support can be in Ramdani (Figs.7-11 and column 13, line 38 – column 16, line 21). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the device of the combination of Bevk and Liaw would also include the claimed limitations as is well-known or as supported by the teachings of Ramdani.

(10) Response to Argument

Appellants' arguments filed 10/27/2008 have been fully considered but they are not persuasive.

With respect to Liaw, the appellants argue, "…The Applicants respectfully disagree with the Examiner that FIG. 4, and the associated text, teaches or suggests the claimed element of source/drain regions located within a doped epitaxial layer proximate a gate structure, wherein the source/drain regions do not extend into a co-doped germanium buried layer located thereunder, as is presently claimed. For instance, all the text associated with FIG. 4 is directed to a SiC buried layer. Nothing in that text teaches or suggests that the SiC buried layer could be a co-doped germanium buried layer, as is presently claimed…".

In response to this argument, Liaw discloses a MOS device including epitaxial layers made of, for example, silicon germanium and silicon carbide, wherein in one embodiment of the invention (Fig.1) the source/drain regions of the MOS device extend into the epitaxial layer and wherein in a second embodiment of the invention (Fig.4) the source/drain regions of the MOS device does not extend into the epitaxial layer. The appellants assert that in the description of Fig.1 Liaw discloses wherein the epitaxial layer (12) is, for example, silicon germanium and in the description of Fig.4, the epitaxial layer (73, 63) is, for example silicon carbide. However, Liaw further discloses that other epitaxial layers are made of other materials (Liaw, column 5, lines 36 - 50). Also, Liaw discloses that forming these epitaxial layers, wherein, in the case of silicon germanium, at a thickness in the range from about 400 angstroms to about 3000 angstroms (Liaw, column 3, lines 14 – 36) and the doped epitaxial layer located over this silicon germanium layer has a thickness in the range of about 100 angstroms to about 800 angstroms (Liaw, column 4, lines 30 - 41).

In the combination of Bevk and Liaw, the thicknesses of the epitaxial layers and the depth of the source/drain regions are not restricted to a particular combination in order to have a functional device. The appellants' disclosed specification shows that these regions are part of a conventional transistor (Specification, page 19, paragraph [0045]), and accordingly, the appellants have not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension, in this case, another source/drain depth.

Therefore, as stated in the office action mailed on 05/02/2008 and included hereinabove, it would have been within the scope of one of ordinary skill in the art to combine the teachings of Bevk and Liaw to enable the disclosed source/drain regions of the CMOS of Bevk according to the teachings of Liaw because one of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful source/drain regions in Bevk and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

As to the appellants' arguments in regards to claims 42-53, no specific argument was properly addressed to the specific limitations in these claims. The appellants argue the base limitations disclosed in independent claim 41.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Julio J. Maldonado/

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